PATENT ABSTRACTS OF JAPAN

(11)Publication number : 06-173240
(43)Date of publication of application : 21.06.1994

(51)Int.Cl. E02D 1/00
E21B 47/06

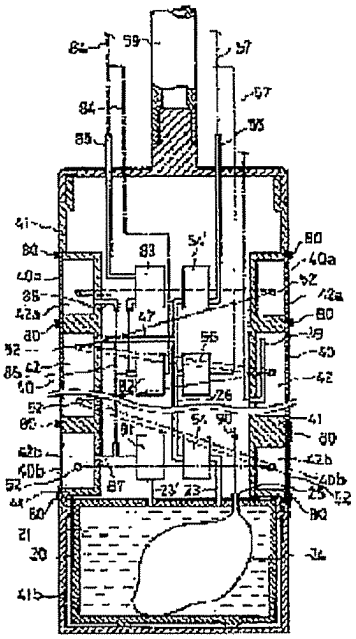
(21)Application number : 04-331582
(22)Date of filing : 11.12.1992

(71)Applicant : TAKENAKA KOMUTEN CO LTD
TOKYO SOIL RES:KK
TAKENAKA DOBOKU CO LTD

(72)Inventor : HATANAKA MUNENORI
SUZUKI YOSHIO
UCHIDA AKIHIKO
OHARA ATSURO
MINAMISAKA TAKAHIKO
TAKEHARA NAOTO
KANZAKI YASUSHI
SAKAGUCHI SHUJI

(54) ORIGINAL POSITION TESTING DEVICE FOR OBTAINING HORIZONTAL STRESS OF GROUND BY FREEZING ORIGINAL POSITION GROUND

(57)Abstract:
PURPOSE: To obtain the horizontal stress of noncohesive soil in the original position.
CONSTITUTION: In an original position testing device for obtaining the horizontal stress of the original position ground, the pressure space with its peripheral side face formed of a rubber sleeve takes such a form that a total of at least three pressure spaces, that is, the original testing pressure space 42 and independent auxiliary pressure spaces 42a, 42b vertically adjacent thereto are placed in a row in the axial direction of the testing device. The testing pressure space 42 and two auxiliary pressure spaces 42a, 42b are filled with cell liquid respectively by independent supply systems 47, 86, 87, and cell liquid pressure acting upon the respective rubber sleeves 40, 40a, 40b is controlled by the independent pressure control systems 55, 56, 57 and 82, 84, 85. The horizontal stress of the ground by freezing original position ground is thereby obtained with high accuracy.



(19)日本国特許庁（ＪＰ）　(12)**公開特許公報**（Ａ）　(11)特許出願公開番号

特開平6－173240

(43)公開日　平成６年(1994)６月21日

(51)Int.Cl.[5]	識別記号	庁内整理番号	ＦＩ	技術表示箇所
Ｅ０２Ｄ　1/00		9013－2D		
Ｅ２１Ｂ　47/06				

審査請求　未請求　請求項の数３(全　７　頁)

(21)出願番号　特願平4－331582

(22)出願日　平成４年(1992)12月11日

(71)出願人　000003621
株式会社竹中工務店
大阪府大阪市中央区本町４丁目１番13号

(71)出願人　000151368
株式会社東京ソイルリサーチ
東京都目黒区東が丘２丁目11番16号

(71)出願人　000150110
株式会社竹中土木
東京都中央区銀座８丁目21番１号

(72)発明者　畑中　宗憲
東京都江東区南砂二丁目５番14号　株式会社竹中工務店技術研究所内

(74)代理人　弁理士　山名　正彦

最終頁に続く

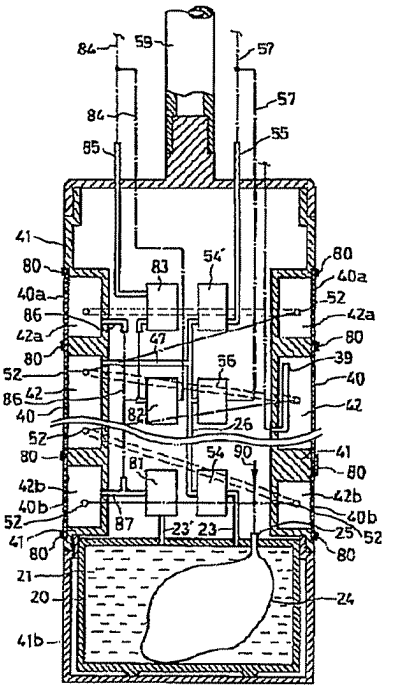
(54)【発明の名称】　原位置地盤凍結による地盤の水平方向応力を求める原位置試験装置

(57)【要約】

【目的】　非粘性土の水平方向応力を原位置で求める原位置試験装置である。

【構成】　原位置地盤の水平方向応力として求める原位置試験装置において、周側面をゴムスリーブで形成された加圧空間は、本来の試験用加圧空間４２のほか、その上下に隣接して設けられた独立の補助用加圧空間４２ａ、４２ｂとの少なくとも合計３個を試験装置の軸線方向に並べた形で形成され、前記試験用加圧空間４２と二つの補助用加圧空間４２ａ、４２ｂとに各々独立した供給系統４７、８６、８７でセル液が満たされ、かつ独立の圧力制御系統５５、５６、５７と８２、８４、８５によって各ゴムスリーブ４０と４０ａ、４０ｂに作用するセル液圧力が制御されることを特徴とする。

【効果】　原位置地盤凍結による地盤の水平方向応力が高精度に求められる。



1

【特許請求の範囲】

【請求項１】　凍結地盤中に掘削した所望深さの試験用孔中の試験位置に挿入され、周側面をゴムスリーブで形成された加圧空間の前記ゴムスリーブを膨張させ孔壁面に当接させることによって試験準備を整え、原位置の凍結地盤が融けるのに伴い地盤が前記試験用孔の半径方向に変形しようとする水平方向ひずみを前記ゴムスリーブに作用する流体圧力で拘束する制御を行ない、原位置の凍結地盤が完全に融けた時に前記ゴムスリーブに作用している流体圧力を原位置地盤の水平方向応力として求める原位置試験装置において、

周側面をゴムスリーブで形成された加圧空間は、本来の試験用加圧空間と、その上下に隣接して設けられた独立の補助用加圧空間との少なくとも合計３個を試験装置の軸線方向に並べた形で形成され、前記試験用加圧空間と二つの補助用加圧空間とに各々独立した供給系統でセル液が満たされ、かつ独立の圧力制御系統によって各ゴムスリーブに作用するセル液圧力が制御されることを特徴とする、原位置地盤凍結による地盤の水平方向応力を求める原位置試験装置。

【請求項２】　試験用加圧空間及び補助用加圧空間に接続されたセル液供給管の途中にそれぞれ二方向電磁弁が設けられ、この二方向電磁弁で分岐され垂直上向きの配置とされた水頭管は装置ハウジングに付設した断熱容器の中に収納して設置されており、前記断熱容器の中に前記水頭管を水没させる程度に封印水が満たされ、前記封印水を加熱するヒータ、及び封印水の水温を測定する温度センサが付設されていることを特徴とする、請求項２に記載した原位置地盤凍結による地盤の水平方向応力を求める原位置試験装置。

【請求項３】　ゴムスリーブで加圧空間が形成される装置ハンジングに断熱性のセル液容器が付設され、前記セル液容器内にセル液が収容され、セル液容器のセル液出口に接続したセル液供給管は二方向電磁弁を介してゴムスリーブの内側の加圧空間及び水頭管と接続されていること、及び前記セル液容器の中にエアバックが設置され、前記エアバックの空気出入口は地上の空気圧制御機構と接続されていることをそれぞれ特徴とする、請求項１又は２に記載した原位置地盤凍結による地盤の水平方向応力を求める原位置試験装置。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】この発明は、非粘性の砂質地盤や礫質地盤を原位置で凍結した上で当該地盤の水平方向応力を直接原位置で求めるため使用される原位置試験装置に関する。

【０００２】

【従来の技術】地盤工学の分野においては、地盤の原位置における応力状態の推定、確認が重要な事柄の一つである。粘性土地盤については、原位置の応力状態を測定

2

することにある程度成功している。しかし、砂質地盤、礫質地盤といった所謂非粘性土地盤については、いまだ原位置の応力状態を正確に測定することができないでいる。

【０００３】従来、原位置地盤を一次元状態で凍結させると、原位置地盤の応力、ひずみの状態が実情のまま保存される。この凍結地盤に試験用孔を掘削し、その孔壁の水平方向ひずみを拘束した状態で凍結地盤を融解させると、実地盤の水平方向応力を求められることに着目して、原位置地盤凍結による地盤の水平方向応力を求める原位置試験方法及び装置が既に研究され、それらは例えば特開平１－２５０５９１号公報及び特開平３－２８４９０号公報などに記載されて公知に属する。

【０００４】ちなみに、特開平３－２８４９０号公報に記載された原位置試験装置を、図４に基いて概説すれば、次のとおりである。円筒形のゴムスリーブ４０は少し小さい外径の円筒形の装置ハウジング４１の外周に同心円配置に被せられ、前記ゴムスリーブ４０と装置ハウジング４１の外周面との間に完全に密閉された環状の加圧空間４２が形成されている。ゴムスリーブ４０の上下の端部は締付けリング４４とテーパーリング４５及び押えリング４３とで固着されている。加圧空間４２の下部に装置ハウジング４１の中空部内側からセル液供給管４７が接続され、加圧空間４２には脱気された水又は不凍液の如きセル液が満たされている。前記加圧空間４２内にはセル液加温用のヒーター５２も設置されている。前記セル液供給管４７の途中に二方向電磁弁５４が接続され、この二方向電磁弁５４により分岐され垂直上向きの配置とされた水頭管５５に至る管路の途中に、差圧変換器（差圧計）５６が設置されている。前記の差圧変換器５６及び前記水頭管５５の上端に、地上の空気圧制御機構６１から配管された空気圧管５７が共通に接続されている。前記二方向電磁弁５４のセル液供給ポートには地上のセル液供給機構４８から配管されたセル液供給管５３が接続されている。装置ハウジング４１の下面部には試験用孔９内に満たされた孔壁安定液の水圧を計測する水圧検出器５８が下向きに設置されている。

【０００５】この原位置試験装置は、ロッド５９の先端部に取り付けられ、凍結された原位置地盤に掘削された試験用孔９内に地上から挿入して使用される。試験用加圧空間４２へセル液を供給してゴムスリーブ４０を膨張させ孔壁面に当接させることによって試験準備を整え、原位置の凍結地盤が融けるのを待つ。凍結地盤の融解と共に応力解放に起因する孔壁の変形（水平方向歪み）を、前記試験用加圧空間４２内のセル液圧力を加減して拘束する（前記変形を零に制御する所謂K_0状態を保つ）と、原位置の凍結地盤が完全に融解した時点のセル液圧力を原位置地盤の水平方向応力として求められる。

【０００６】差圧変換器５６は孔壁の変形（水平方向ひずみ）を検出し、地上の空気圧制御機構６１で調節され

た空気圧が水頭管５５を通じてセル液に加えられ、孔壁の変形を零に戻すようにフィードバック制御が行なわれる。その間、ヒーター５２は凍結地盤と接する試験用加圧空間４２のセル液を加温し、その温度を略一定に保ち測定誤差の発生を防ぐ。前記K₀状態を保つのに必要とされた試験用加圧空間４２内のセル液圧力は空気圧計６２の空気圧の大きさとして計測され、この計測値を水圧検出器５８で求めた原位置の孔内水圧と比較考量することにより、原位置地盤（実地盤）の水平方向応力（有効応力）が求められる。

【０００７】図４において、符号５０は脱気部４９からの脱気ノズルで、空気抜き弁５１が取付けられている。前記空気圧制御機構６１はサーボモータ６５で駆動される空気圧力調節器６６で構成され、空気圧力調節器６６に空気圧源６０が接続されている。前記の差圧変換器５６で計測した水平方向ひずみの計測値がひずみ増幅器６３へ入力され、これに基づくサーボ制御器６４の出力でサーボモータ６５が自動制御される。

【０００８】

【本発明が解決しようとする課題】

① この原位置試験装置をスムーズに試験用孔９内へ挿入し設置するため、試験用孔９の口径は試験装置の外径よりも少し大きく形成される。このため、図４に示した従来の原位置試験装置の試験用加圧空間４２の外周面を形成するゴムスリーブ４０で変形を拘束した孔壁部分に隣接する上下の孔壁は、凍結の融解に伴って自由に変形し崩壊を生ずる。その結果、前記隣接孔壁の変形や崩壊の影響がゴムスリーブ４０で拘束した試験部分の孔壁に大なり小なりの影響を及ぼし、それが試験誤差の原因となることが推定され、この点の解決が必要である。

② 原位置試験装置の一般的使用法は、地上で予めセル液を適量注入して凍結地盤の試験用孔９の中へ挿入されるが、通常－２０℃程度の不凍液（安定液）で満たされた試験用孔９の中へ目標の試験位置まで下ろして試験の準備をする間にセル液は強く冷却される。とりわけ細く長い水頭管５５内の水は凍結してしまい（図４参照）、試験用加圧空間４２内のセル液の体積変化が精度良く水位の変動に変換されない状態となって試験不能に陥る不都合が起こり得る。

③ 同様に、試験用孔９の中へ挿入した原位置試験装置の試験準備のため、地上のセル液供給機構４８からセル液を供給しようとしても、原位置試験装置に至るセル液供給管５３（図４参照）内の水が凍結していまい供給不能となる不都合が起こり得る。

【０００９】従って、本発明の目的は、上記の各問題点、とりわけ試験用加圧空間の外周面を形成するゴムスリーブで変形を拘束した孔壁部分に隣接する上下の自由な孔壁部分の変形、崩壊に起因する試験誤差の発生を未然に防止して試験精度を高めた原位置試験装置を提供することにある。

【００１０】

【課題を解決するための手段】上述した従来技術の課題を解決するための手段として、この発明に係る原位置地盤凍結による地盤の水平方向応力を求める原位置試験装置は、図１～図３に実施例を示したとおり、凍結地盤中に掘削した所望深さの試験用孔９中の試験位置に挿入され、周側面をゴムスリーブ４０で形成された加圧空間４２の前記ゴムスリーブ４０を膨張させ孔壁面に当接させることによって試験準備を整え、原位置の凍結地盤が融けるのに伴い地盤が前記試験用孔９の半径方向に変形しようとする水平方向ひずみを前記ゴムスリーブ４０に作用する流体圧力で拘束する制御を行ない、原位置の凍結地盤が完全に融けた時に前記ゴムスリーブ４０に作用している流体圧力を原位置地盤の水平方向応力として求める原位置試験装置において、周側面をゴムスリーブで形成された加圧空間は、本来の試験用加圧空間４２のほか、その上下に隣接して設けられた独立の補助用加圧空間４２ａ、４２ｂとの少なくとも合計３個を試験装置の軸線方向に並べた形で形成され、前記試験用加圧空間４２と二つの補助用加圧空間４２ａ、４２ｂとに各々独立した供給系統４７、８６、８７でセル液が満たされ、かつ独立の圧力制御系統５５、５６、５７と８２、８４、８５によって各ゴムスリーブ４０と４０ａ、４０ｂに作用するセル液圧力が制御されることを特徴とする（図１）。

【００１１】本発明の原位置試験装置はまた、前記試験用加圧空間４２及び補助用加圧空間４２ａ、４２ｂに接続されたセル液供給管４７と８６、８７の途中にそれぞれ二方向電磁弁５４、８１が設けられ、この二方向電磁弁５４、８１で分岐され垂直上向きの配置とされた水頭管５５と８５は装置ハウジング４１に付設した断熱容器１０の中に収納して設置され、前記断熱容器１０の中に前記水頭管５５を水没させる程度に封印水１１が満たされ、前記封印水１１を加熱するヒータ１２、及び封印水１１の水温を測定する温度センサ１３が付設されていること（図２）、及び、ゴムスリーブで加圧空間が形成される装置ハンジング４１に断熱性のセル液容器２０が付設され、前記セル液容器２０内にセル液２１が収容され、セル液容器２０のセル液出口１９に接続したセル液供給管２３と２３’は前記二方向電磁弁５４、８１を介してゴムスリーブ４０と４０ａ、４０ｂの内側の加圧空間４２と４２ａ、４２ｂ及び水頭管５５、８５と接続され、前記セル液容器２０の中にエアバック２４が設置され、前記エアバック２４の空気出入口２５は地上の空気圧制御機構と接続されていること（図３）、もそれぞれ特徴とする。

【００１２】

【作用】

（ａ）試験用加圧空間４２の外周面を形成するゴムスリーブ４０で変形を拘束した孔壁の上下に隣接する孔壁部

分は、上下の補助用加圧空間４２ａと４２ｂの外周面を形成するゴムスリーブ４０ａと４０ｂで同様に変形を拘束される。よって、上下に隣接する非拘束の変形が自由な孔壁部分の変形や崩壊の影響は前記試験用加圧空間４２のゴムスリーブ４０で拘束した孔壁部分に及ぶことはほとんどなく、高い試験精度を確保できる。

（ｂ）細く長い水頭管５５は、第一に断熱容器１０によって外周から伝わる冷熱から保護される。第二には断熱容器１０内に収容した封印水１１によっても冷却から保護される。その上、封印水１１の水温は温度センサ１３で測定し、温度制御装置を通じて封印水１１の水温を略一定の温度に保つので、水頭管５５内の水が凍結するおそれは決してなく、温度差（水の体積変化）に伴う試験誤差を微小化できる。

（ｃ）原位置試験装置の機能上必要とされる量のセル液２１が断熱性のセル液容器２０内に予め地上で収容され、試験装置と共に試験用孔９内に下される。断熱性のセル液容器２０に収容されたセル液２１は、周囲からの強い冷却から保護されるので凍結する心配もない。そして、地上の空気圧制御機構を操作してエアバッグ２４を膨張させると、その膨張体積相当文のセル液２１がセル液容器２０から送り出され、二方向電磁弁５４を経て試験用加圧空間４２あるいは補助用加圧空間４２ａ、４２ｂへ供給又は補給される。従って、従来のように原位置試験装置と地上のセル液供給機構（図４の符号４８を参照）とを連結するセル液供給管（図４の符号４８、５３を参照）を用意してセル液を補充することは一切無用である。よって、前記セル液供給管内の水が凍結することに原因するトラブルのおそれはない。

【００１３】

【実施例】次に図１～図３に示した本発明の実施例を説明する。図１～図３に示した原位置試験装置の構成原理と使用法及び作用（機能）の大部分は、上述した図４の装置とほぼ共通するので、重複する説明は省く。まず、図１に示した原位置試験装置は、原位置の凍結地盤に形成された試験用孔（図４の符号９を参照）の口径と略同径の円筒形（φ１９０、長さ３５０㎜位）をなす上下３個のゴムスリーブ４０と４０ａ、４０ｂが、少し小さい外径（φ１６０）の円筒形状をなす装置ハウジング（以下、単にハウジングと言う）４１の外周に同心円配置に被せられ、ゴムスリーブとハウジングの外周面との間に完全に密閉された環状の加圧空間４２と４２ａ、４２ｂが上下方向に独立して３個隣接して形成されている。符号４２が本来の試験用加圧空間で、４２ａと４２ｂは前記試験用加圧空間４２の上下に隣接して設けられた補助用加圧空間である。図１の実施例では上下３個のゴムスリーブ４０と４０ａ、４０ｂは一連のものとして形成され、各加圧空間４２と４２ａ、４２ｂの境界部分を固定リング８０で締付け固定した構成とされているが、ゴムスリーブを各加圧空間毎に独立のものとして形成し実施

することもよい。前記ゴムスリーブの両端部は、一層具体的には図２と図３に詳示したように、ハウジング４１へねじ込まれた締付けリング４４でテーパーリング４５を押し込むことにより、くさび効果で強固に固定され水密性が保持されている。前記３個の加圧空間４２と４２ａ、４２ｂには、セル液の供給管４７と８６、８７が各々前記円筒形のハウジング４１の中空部からノズル４６を介して接続され、３個の加圧空間４２と４２ａ、４２ｂ内には脱気された水又は不凍液の如きセル液が個別の供給系統で満たされている。また、各加圧空間４２と４２ａ、４２ｂ内には、試験中にセル液の温度を約１２℃～１３℃の範囲に保ち、セル液の体積変化に起因する試験誤差を防ぐフレックスヒーター５２が設置されている。各加圧空間４２と４２ａ、４２ｂ内にセル液の温度は熱電対３９で計測し、地上の温度制御機構（図示は省略）で管理される。前記セル液供給管４７と８６、８７の途中に二方向電磁弁５４と５４’及び８１と８３が設置され、上方の二方向電磁弁５４’と８３によって分岐された管路がハウジング４１の中空部内の上方部分に垂直上向きに配置された水頭管５５、８５と接続されている。

【００１４】この原位置試験装置の使用上必要な量のセル液は、ハウジング４１の下部に取り付けた保護ケース４１ｂ内に断熱性材質によるセル液容器２０を付設し、該セル液容器２０内に収容されている。セル液容器２０の中には同容器２０の内容積と等しい体積に膨脹可能なエアバッグ２４が設置され、同エアバッグ２４の空気出入口２５に接続した空気管９０を通じて地上の空気圧制御機構から空気を送りエアバッグ２４を適度な大きさ（体積）に膨脹させ、その体積膨脹相当量のセル液が送り出される。前記セル液容器２０には２本のセル液送り出し管２３と２３’が設けられている。一方のセル液送り出し管２３にはまず二方向電磁弁５４が設けられ、差圧変換器５６が設けられ、試験用加圧空間４２に至るセル液供給管４７が分岐された位置より上方に第２の二方向電磁弁５４’が設けられ、その上方の水頭管５５と接続されている。地上の図示を省略した空気圧制御機構（図４の符号６１、６２等を参照）から配管された空気圧管５７が、途中で分岐されて前記水頭管５５及び差圧変換器５６と接続されている。

【００１５】他方のセル液送り出し管２３’にも、まず二方向電磁弁８１が設けられ、その先の管路は下側の補助用加圧空間４２ｂへ至るセル液供給管８７と、上側の補助用加圧空間４２ａへ至るセル液供給管８６とに分岐され、垂直に立ち上がる液供給管８６の途中に差圧変換器８２が設けられている。また、前記セル液供給管８６の上部に第２の二方向電磁弁８３が設けられ、その上方の水頭管８５と接続されている。そして、同じく地上の空気圧制御機構（前記空気圧管５７に係る空気圧制御機構と類似的構成であるが、独立した機構）から配管され

た空気圧管８４が、途中で2本に分岐されて前記水頭管８５及び差圧変換器８２と接続されている。

【００１６】従って、この原位置試験装置は、ボーリングロッド５９の先端に取り付けて試験用孔９（図４参照）内に下ろし、試験位置に達した段階で、まず空気圧管９０を通じて空気を送りエアバッグ２４を膨脹させて試験用加圧空間４２及び補助用加圧空間４２ａ、４２ｂへセル液を供給し又は補充する。しかる後に地上の空気圧制御機構を通じて水頭管５５と８５及び差圧変換器５６と８２へ空気圧を作用させ、試験用加圧空間４２のゴムスリーブ４０及びその上下の補助用加圧空間４２ａと４２ｂのゴムスリーブ４０ａと４０ｂにそれぞれ孔壁の半径方向（水平方向）の変位を零に拘束する（所謂K₀状態を保つ）強さのセル液圧力を作用させる。かくして原位置の凍結地盤が完全に融解した時点における前記試験用加圧空間４２内のセル液圧力が水頭管５５と差圧変換器５６に作用させた空気圧管５７内の空気圧の大きさとして例えば図４の空気圧を計６２で読み取られ、真正な水平方向応力が求められる。

【００１７】

【異なる実施態様】図１の実施例では、水頭管５５、８５が装置ハウジング４１の上方へ少し突き出ている。また、図４の従来例では水頭管５５が装置ハウジング４１の上方へ完全に露出されている。従って、こうした水頭管５５、８５は、試験用孔内に満たされた－２０℃程度の孔壁安定液の冷熱によって強く冷却され、管内の水（セル液）が凍結する不都合がある。こうした不都合を回避するために、図２の実施例では、水頭管５５（及び水頭管８５も同様。但し、具体的な図示は省略した。以下同じ。）は、断熱性に優れたアクリル樹脂製で立型円筒形状をなす透明な断熱容器１０内の中心部に垂直に設置されている。断熱容器１０は、ハウジング４１の上端に水密的に継ぎ足された透明なアクリル樹脂製の円筒部４１ａの中空部内の上方部位に設置されている。但し、その場所は実施例の限りではない。断熱容器１０の中には断熱用の封印水１１が前記水頭管５５の前部を水没させるレベルに満たされ、この封印水１１を加温するヒータ１２も設置されている。更に前記断熱容器１０の上下に温度センサとしての熱電対１３が設置されている。熱電対１３の計測値は地上の温度制御機構（図示省略）に入力され、水温が下がり君の場合にはヒータ１２を発熱させて封印水１１の水温を、ひいては水頭管５５内の水温を約１２℃～１３℃に保つ温度制御が行なわれる。従って、水頭管５５内の水の凍結の心配は全くないし、水の体積変化による試験誤差の心配もない。前記断熱容器１０の上部には、前記水頭管５５に連通する、かなり大きな容量の水溜り７２が設けられている。これは試験準備の際に水頭管５５内の水がオーバーフローした場合でも、前記の水溜り７２にオーバーフロー水を収容させ、その位置より上方の空気圧管５７にまでは入り込ませない構成とするためである。

【００１８】前記アクリル樹脂製の円筒部４１ａの上端にエンドプレート３０が水密的に設置され、このエンドプレート３０の上面中央部に、地上で支持されたボーリングロッド５９を接合するジョイント部３１が設けられている。図１中の符号２９は各制御信号線などの接続用として設けられた防水メタルコンセントである。次に、図３は、エアバッグ２４を内蔵したセル液容器部分の異なる構成の実施例を示している。前記ハウジング４１の下端部にステンレス鋼製の保護ケース４１ｂが継ぎ足され、この保護ケース４１ｂの中空部内に、断熱性の合成樹脂製で密閉容器構造のセル液容器２０が収納されている。このセル液容器２０は、当該原位置試験装置の機能上必要とされる量のセル液２１を収納可能な内容量で形成されている。前記のセル液容器２０には、その底部付近に出口２２ａをもつセル液導出孔２２がセル液容器２０の側壁を上端まで貫通されている。前記セル液導出孔２２の上端出口に取り付けた出口ノズル１９が、セル液供給管２３'（及びセル液供給管２３も同じ。但し、図示は省略した。）によって上記補助用加圧空間４２ｂのための二方向電磁弁８１のノズル１８と接続されている。前記セル液容器２０の中に、同容器２０の天端壁に空気出入口ノズル２５をもつエアバッグ２４が収納されている。エアバッグ２４を膨脹させることによってセル液容器２０から押し出されたセル液２１は、セル液供給管２３、２３'から二方向電磁弁５４、８１を経て、試験用加圧空間４２あるいは補助用加圧空間４２ａ及び４２ｂへ供給される。前記エアバッグ２４の空気出入口ノズル２５に空気圧管９０が接続され、これが地上の図示を省略した空気圧制御機構と接続されている。

【００１９】なお、原位置試験装置を試験用孔内に下して試験準備を整える間、及び試験中に、試験用加圧空間４２及び補助用加圧空間４２ａ、４２ｂ内のセル液の水温を約１２℃～１３℃の範囲に保つ温度制御、及び水頭管５５内の水の温度を略一定に保つ温度制御が、温度センサ３９と１３による計測及びヒータ５２と１２による加温とによって行なわれ、試験精度の確保が行なわれる。

【００２０】

【本発明が奏する効果】本発明に係る原位置試験装置によれば、原位置地盤凍結による地盤の水平方向応力が、試験用加圧空間４２のゴムスリーブ４０で拘束した孔壁部分に隣接する上下の孔壁部分の変形や崩壊による悪影響が上下の補助用加圧空間４２ａと４２ｂのゴムスリーブ４０ａと４０ｂによって阻止され、高精度に求められる。その上、セル液の凍結によるトラブルの心配もなく、また、水の温度変化（水の体積変化）に起因する誤差がほとんどない状態で高精度に高信頼性の試験を行なえる。

【図面の簡単な説明】

9　　10

【図1】本発明に係る原位置試験装置の実施例を簡単化して示した断面図である。

【図2】本発明に係る原位置試験装置の他の実施例の上半分を示した断面図である。

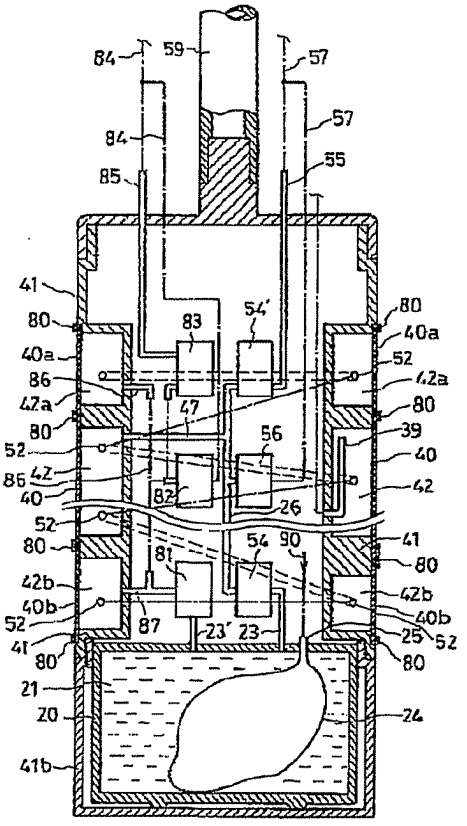
【図3】図2の原位置試験装置の下半分を示した断面図である。

【図4】従来の原位置試験装置の断面図である。

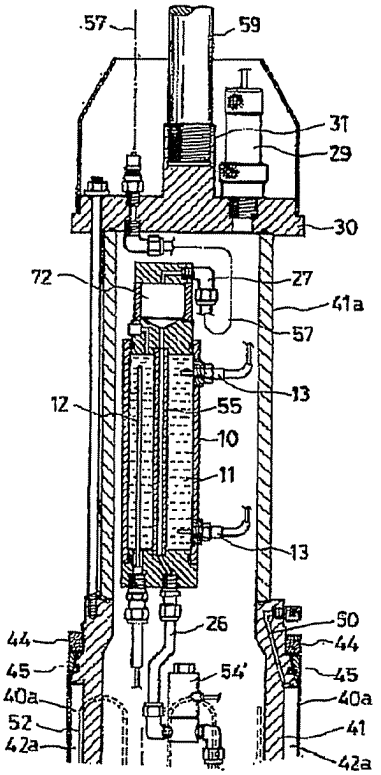
【符号の説明】

9　試験装置
40　ゴムスリーブ
40a、40b　ゴムスリーブ
42　試験用加圧空間
42a、42b　補助用加圧空間
＊47　セル液の供給管
86、87　セル液の供給管
55　水頭管
85　水頭管
10　断熱容器
11　封印水
12　ヒータ
13　熱電対
20　セル液容器
21　セル液
23　供給管
24　エアバッグ

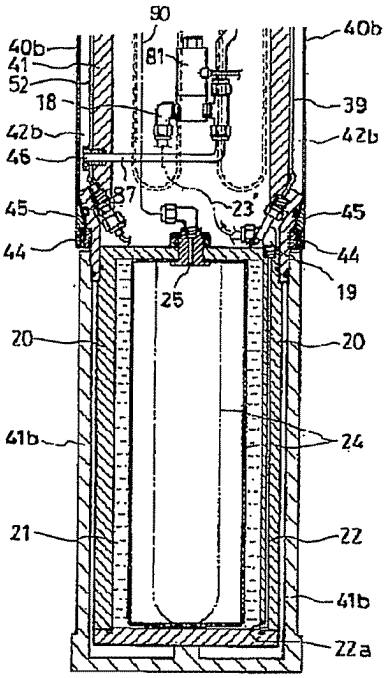
【図1】



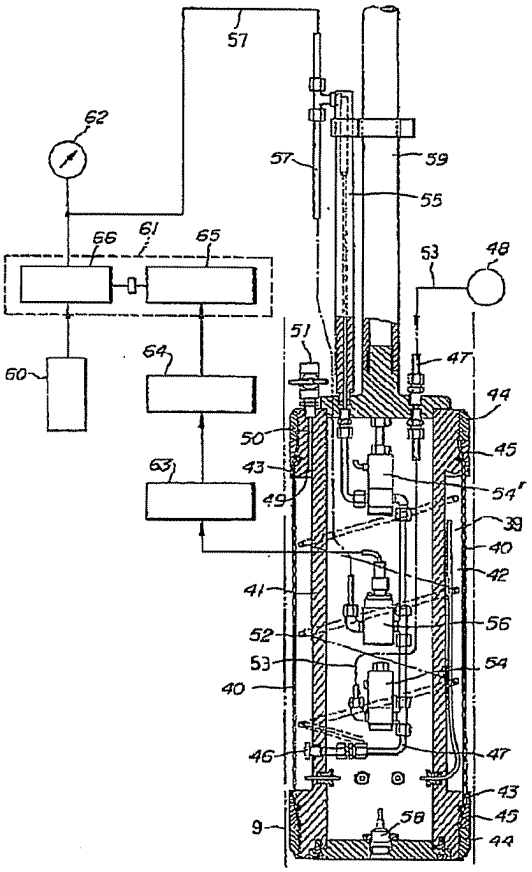
【図2】



【図3】



【図4】



フロントページの続き

(72)発明者　鈴木　善雄
東京都江東区南砂二丁目５番14号　株式会社竹中工務店技術研究所内
(72)発明者　内田　明彦
東京都江東区南砂二丁目５番14号　株式会社竹中工務店技術研究所内
(72)発明者　大原　淳良
東京都目黒区東が丘二丁目11番16号　株式会社東京ソイルリサーチ内
(72)発明者　南坂　貴彦
東京都目黒区東が丘二丁目11番16号　株式会社東京ソイルリサーチ内
(72)発明者　竹原　直人
東京都目黒区東が丘二丁目11番16号　株式会社東京ソイルリサーチ内
(72)発明者　神崎　靖
東京都中央区銀座八丁目21番１号　株式会社竹中土木内
(72)発明者　坂口　修司
東京都中央区銀座八丁目21番１号　株式会社竹中土木内

CLAIMS

[Claim(s)]
[Claim 1]It is inserted in a test position in a hole for an examination of the request depth excavated in a frozen ground board, Test preparation is made by expanding said sealing sleeve of pressurized space formed by a sealing sleeve in a peripheral flank, and making a porous wall side contact, Control which restrains a horizontal strain which the foundation tends to transform into a radial direction of said hole for an examination in connection with a frozen ground board of an original position melting with fluid pressure which acts on said sealing sleeve is performed, In original position test equipment which asks for fluid pressure which is acting on said sealing sleeve when a frozen ground board of an original position melts thoroughly as horizontal stress of the original position foundation, Pressurized space formed by a sealing sleeve a peripheral flank, It is formed in a form where at least a total of three of original pressurized space for an examination and independent pressurized space for assistance adjoined and established in the upper and lower sides were arranged in an axial direction of test equipment, Original position test equipment which asks for horizontal stress of the foundation by original position foundation freezing, wherein cell fluid pressure power of cell liquid being filled with a supplying system which became independent respectively to said pressurized space for an examination and two pressurized space for assistance, and acting on each sealing sleeve by an independent pressure-control system is controlled.
[Claim 2]An electromagnetic valve for two way types is formed in the middle of a cell liquid feed pipe connected to pressurized space for an examination, and pressurized space for assistance, respectively, A head-of-water pipe which branched with this electromagnetic valve for two way types, and was considered as vertical upward arrangement is stored and installed into a heat insulation container attached to device housing, Original position test equipment which asks for horizontal stress of the foundation by original position foundation freezing indicated to claim 2 which seal water is filled to such an extent that said head-of-water pipe is sunk in said heat insulation container, and is characterized by attaching a heater which heats said seal water, and a temperature sensor which measures water temperature of seal water.
[Claim 3]An adiathermic cell liquid container is attached to device HANJINGU in which pressurized space is formed by a sealing sleeve, A cell liquid feed pipe which cell liquid was accommodated in said cell liquid container, and was connected to a cell liquid port of a cell liquid container is connected with pressurized space inside a sealing sleeve, and a head-of-water pipe via an electromagnetic valve for two way types, And original position test equipment which an air bag is installed into said cell liquid container, and is characterized by connecting said air bag's air gate with a terrestrial pneumatic-control mechanism,

respectively and which asks for horizontal stress of the foundation by original position foundation freezing indicated to claim 1 or 2.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application]This invention relates to the original position test equipment used in order to ask for the horizontal stress of the foundation concerned directly in an original position after freezing nonviscous sandy ground and rudaceous ground in an original position.
[0002]
[Description of the Prior Art]in the field of geotechnical engineering, presumption of the stress state in the original position of the foundation and a check are one of the important matters. About the cohesive soil foundation, it has succeeded in measuring the stress state of an original position to some extent. However, about what is called nonviscous land boards, such as sandy ground and rudaceous ground, the stress state of an original position cannot yet be measured correctly.
[0003]When the original position foundation is conventionally frozen in the state of one dimension, it is saved while the stress of the original position foundation and a state of strain have been the actual condition. If a frozen ground board is dissolved where it excavated the hole for an examination to this frozen ground board and the horizontal strain of that porous wall is restrained, Paying attention to the ability to ask for the horizontal stress of the real foundation, the original position test method and device which ask for the horizontal stress of the foundation by original position foundation freezing are already studied, and they are indicated to JP,1-250591,A, JP,3-28490,A, etc., and belong publicly known.
[0004]It will be as follows if the original position test equipment indicated to JP,3-28490,A is incidentally outlined based on drawing 4. The sealing sleeve 40 of a cylindrical shape is put on the periphery of the device housing 41 of the cylindrical shape of a somewhat small outer diameter at concentric circle arrangement, and the annular pressurized space 42 sealed thoroughly is formed between said sealing sleeve 40 and the peripheral face of the device housing 41. The end of the upper and lower sides of the sealing sleeve 40 has adhered by the clamping ring 44, the taper ring 45, and the ferrule 43. The cell liquid feed pipe 47 is connected to the lower part of the pressurized space 42 from the centrum inside of the device housing 41, and the deaerated water or the cell liquid like an antifreeze solution is filled in the pressurized space 42. In said pressurized space 42, the heater 52 for cell liquid humidification is also installed. The electromagnetic valve 54 for two way types is connected in the middle of said cell liquid feed pipe 47, and the differential pressure transducer (differential pressure gauge) 56 is installed in the middle of

the pipeline which results in the head-of-water pipe 55 which branched with this electromagnetic valve 54 for two way types, and was considered as vertical upward arrangement. The pneumatic pressure pipe 57 piped from the terrestrial pneumatic-control mechanism 61 is connected to the upper bed of the aforementioned differential pressure transducer 56 and said head-of-water pipe 55 in common. The cell liquid feed pipe 53 piped from the terrestrial cell liquid feed mechanism 48 is connected to the cell liquid supply port of said electromagnetic valve 54 for two way types. The water pressure detector 58 which measures the water pressure of the porous wall slurry filled in the hole 9 for an examination in the undersurface part of the device housing 41 is installed downward.

[0005]This original position test equipment is used from the ground, inserting into the hole 9 for an examination which it was attached to the tip part of the rod 59, and was excavated on the frozen original position foundation. By supplying cell liquid to the pressurized space 42 for an examination, expanding the sealing sleeve 40, and making a porous wall side contact, test preparation is made and it waits for the frozen ground board of an original position to melt. adjusting the cell fluid pressure power in said pressurized space 42 for an examination for modification (horizontal distortion) of the porous wall which originates in release of in-situ stress with fusion of a frozen ground board -- restraining (what is called a K_0 state that controls said modification to zero is maintained). The cell fluid pressure power at the time of the frozen ground board of an original position dissolving thoroughly is called for as horizontal stress of the original position foundation.

[0006]The differential pressure transducer 56 detects modification (horizontal strain) of a porous wall, the pneumatic pressure adjusted by the terrestrial pneumatic-control mechanism 61 is applied to cell liquid through the head-of-water pipe 55, and feedback control is performed so that modification of a porous wall may be returned to zero. In the meantime, the heater 52 warms the cell liquid of the pressurized space 42 for an examination which touches a frozen ground board, maintains the temperature at approximately regulated, and prevents generating of an error of measurement. By measuring the cell fluid pressure power in the pressurized space 42 for an examination needed for maintaining said K_0 state as a size of the pneumatic pressure of the pneumatic pressure indicator 62, and carrying out comparison ponderation with the hole internal water pressure of the original position which calculated this measurement value with the water pressure detector 58, The horizontal stress (effective stress) of the original position foundation (real foundation) is called for.

[0007]In drawing 4, the numerals 50 are the deaeration nozzles from the degassing part 49, and the purge valve 51 is attached. Said pneumatic-control mechanism 61 comprises the air pressure regulator 66 driven with the servo motor 65, and the pneumatic pressure source 60 is connected to the air pressure regulator 66. The measurement value of the horizontal strain measured with the aforementioned differential pressure transducer 56 is distorted, it is inputted into the amplifier 63, and the automatic control of the servo motor 65 is carried out with the output of the servo control machine 64 based on this.

[0008]

[Problem(s) to be Solved by the Invention]

** In order to insert this original position test equipment into the hole 9 for an examination smoothly and to install it, the caliber of the hole 9 for an examination is formed somewhat more greatly than the outer diameter of test equipment. For this reason, the porous wall of the upper and lower sides which adjoin the porous wall portion which restrained modification by the sealing sleeve 40 which forms the peripheral face of

the pressurized space 42 for an examination of the conventional original position test equipment shown in drawing 4 changes freely with fusion of freezing, and produces collapse. As a result, it has influence of smallness on the porous wall of the examination portion which the modification of said contiguity porous wall and the influence of collapse restrained by the sealing sleeve 40 in size, it is presumed that it causes an examination error, and this point needs to be solved.

** Although the general directions of original position test equipment pour in a proper quantity of cell liquid beforehand on the ground and it is inserted into the hole 9 for an examination of a frozen ground board, while taking down to a target test position into the hole 9 for an examination usually filled with an about -20 ** antifreeze solution (slurry) and carrying out pretest preparation, cell liquid is cooled strongly. The water in the thin long head-of-water pipe 55 is especially frozen (refer to drawing 4), and the inconvenience by which the volume change of the cell liquid in the pressurized space 42 for an examination will be in the state where it is not changed into change of a water level with sufficient accuracy, and falls into examination impossible may happen.

** Even if it is going to supply cell liquid from the terrestrial cell liquid feed mechanism 48 similarly for test preparation of original position test equipment inserted into the hole 9 for an examination, the inconvenience it becomes impossible supplying [which the water in the cell liquid feed pipe 53 (refer to drawing 4) which results in original position test equipment will not freeze] may happen.

[0009]Therefore, modification of the free-hole wall parts of the upper and lower sides by which the porous wall portion into which, as for the purpose of this invention, modification was restrained at each of above-mentioned problems and the sealing sleeve which especially forms the peripheral face of the pressurized space for an examination is adjoined, It is in providing the original position test equipment which prevented generating of the examination error resulting from collapse beforehand, and raised test accuracy.

[0010]

[Means for Solving the Problem]Original position test equipment which asks for horizontal stress of the foundation by original position foundation freezing concerning this invention as The means for solving a technical problem of conventional technology mentioned above, It is inserted in a test position in the hole 9 for an examination of the request depth excavated in a frozen ground board as an example was shown in drawing 1 - drawing 3, Test preparation is made by expanding said sealing sleeve 40 of the pressurized space 42 formed by the sealing sleeve 40 in a peripheral flank, and making a porous wall side contact, Control which restrains a horizontal strain which the foundation tends to transform into a radial direction of said hole 9 for an examination in connection with a frozen ground board of an original position melting with fluid pressure which acts on said sealing sleeve 40 is performed, In original position test equipment which asks for fluid pressure which is acting on said sealing sleeve 40 when a frozen ground board of an original position melts thoroughly as horizontal stress of the original position foundation, Pressurized space formed by a sealing sleeve a peripheral flank, The independent pressurized space 42a for assistance adjoined and established in its upper and lower sides besides the original pressurized space 42 for an examination, The pressure-control system 55 independent [that it is formed in a form where at least a total of three with 42b were arranged in an axial direction of test equipment, and cell liquid is filled with the supplying systems 47, 86, and 87 which became independent respectively to said pressurized space 42 for an examination, and the two pressurized space 42a and 42b for assistance], Each sealing sleeve 40 and cell fluid pressure

power of acting on 40a and 40b are controlled by 56, 57, and 82, 84 and 85 (drawing 1).
[0011]Again original position test equipment of this invention Said pressurized space 42 for an examination, and the pressurized space 42a for assistance, The electromagnetic valves 54 and 81 for two way types are formed in the middle of the cell liquid feed pipes 47 and 86 connected to 42b, and 87, respectively, The head-of-water pipes 55 and 85 which branched with these electromagnetic valves 54 and 81 for two way types, and were considered as vertical upward arrangement are stored and installed into the heat insulation container 10 attached to the device housing 41, The seal water 11 is filled to such an extent that said head-of-water pipe 55 is sunk in said heat insulation container 10, The heater 12 which heats said seal water 11, and the temperature sensor 13 which measures water temperature of the seal water 11 are attached (drawing 2), And the adiathermic cell liquid container 20 is attached to device HANJINGU 41 in which pressurized space is formed by a sealing sleeve, In the cell liquid feed pipes 23 and 23 which the cell liquid 21 was accommodated in said cell liquid container 20, and were connected to the cell liquid port 19 of the cell liquid container 20, via said electromagnetic valves 54 and 81 for two way types The sealing sleeves 40 and 40a, It is connected with the pressurized space 42 inside 40b, 42a and 42b, and the head-of-water pipes 55 and 85, the air bag 24 is installed into said cell liquid container 20, and it is ********** characterized [being connected with a terrestrial pneumatic-control mechanism (drawing 3), and] by said air bag's 24 air gate 25.
[0012]
[Function]
(a) The porous wall portion which adjoins the upper and lower sides of the porous wall which restrained modification by the sealing sleeve 40 which forms the peripheral face of the pressurized space 42 for an examination has modification similarly restrained by the sealing sleeves 40a and 40b which form the peripheral face of the up-and-down pressurized space 42a and 42b for assistance. Therefore, modification of un-restraining [which adjoins up and down] does not almost have that modification of free-hole wall parts and the influence of collapse attain to the porous wall portion restrained by the sealing sleeve 40 of said pressurized space 42 for an examination, and high test accuracy can be secured.
(b) The thin long head-of-water pipe 55 is protected from the cold energy transmitted in the first place from a periphery with the heat insulation container 10. It is protected from cooling by the second also with the seal water 11 accommodated in the heat insulation container 10. Since the water temperature of the seal water 11 is measured with the temperature sensor 13 and the water temperature of the seal water 11 is moreover maintained at an approximately regulated temperature through a temperature controller, there is never no possibility that the water in the head-of-water pipe 55 may be frozen, and the examination error accompanying a temperature gradient (volume change of water) can be micrified.
(c) The cell liquid 21 of the quantity needed on the function of original position test equipment is beforehand accommodated on the ground in the adiathermic cell liquid container 20, and is given in the hole 9 for an examination with test equipment. The cell liquid 21 accommodated in the adiathermic cell liquid container 20 does not have a fear of freezing, since it is protected from strong cooling from the circumference. And if a terrestrial pneumatic-control mechanism is operated and the air bag 24 is expanded, it is sent out from the cell liquid container 20, and the cell liquid 21 of the expansion body product equivalent sentence will pass through the electromagnetic valve 54 for two way types, and will be supplied or supplied to the pressurized

space 42 for an examination, or the pressurized space 42a and 42b for assistance. Therefore, it is unnecessary entirely to prepare the cell liquid feed pipe (see the numerals 48 and 53 of drawing 4) which connects original position test equipment and a terrestrial cell liquid feed mechanism (see the numerals 48 of drawing 4) like before, and to fill up cell liquid. Therefore, there is no fear of the trouble which results from the water in said cell liquid feed pipe being frozen.

[0013]

[Example]Next, the example of this invention shown in drawing 1 - drawing 3 is described. Since [which were shown in drawing 1 - drawing 3 / the constituting principle of original position test equipment, the directions, and the great portion of operation (function)] are mostly common to the device of drawing 4 mentioned above, the overlapping explanation is omitted. First, the sealing sleeves 40 and 40a of three upper and lower sides which make a cylindrical shape the caliber of the hole for an examination (see the numerals 9 of drawing 4) by which the original position test equipment shown in drawing 1 was formed in the frozen ground board of an original position, and of approximately the same diameter (about phi 190 and 350 mm in length), The device housing in which 40b makes the cylindrical shape of a somewhat small outer diameter (phi 160). (It is only hereafter called housing) The periphery of 41 is covered at concentric circle arrangement, and independently, the annular pressurized space 42 thoroughly sealed between the sealing sleeve and the peripheral face of housing, and three 42a and 42b adjoin a sliding direction, and are formed in it. The numerals 42 are the original pressurized space for an examination, and 42a and 42b are the pressurized space for assistance adjoined and established in the upper and lower sides of said pressurized space 42 for an examination. Although the sealing sleeve 40 of three upper and lower sides, and 40a and 40b are formed as a series of things and considered as the composition which bound tight each pressurized space 42 and the boundary part of 42a and 42b with the stop ring 80, and was fixed in the example of drawing 1, it is also good to form a sealing sleeve as an independent thing and to carry it out for every pressurized space. As the both ends of said sealing sleeve were much more specifically shown in detail to drawing 2 and drawing 3, by pushing in the taper ring 45 with the clamping ring 44 thrust into the housing 41, it is firmly fixed by the wedge effect and ****** is held. To said three pressurized space 42, and 42a and 42b. The feed pipes 47 and 86 of cell liquid and 87 are respectively connected via the nozzle 46 from the centrum of the housing 41 of said cylindrical shape, and the deaerated water or the cell liquid like an antifreeze solution is filled with the individual supplying system in the three pressurized space 42 and 42a and 42b. In each pressurized space 42 and 42a and 42b, the temperature of cell liquid is maintained at the range of about 12 ** - 13 ** during an examination, and the flex time heater 52 which prevents the examination error resulting from the volume change of cell liquid is installed. In each pressurized space 42 and 42a and 42b, the temperature of cell liquid is measured with the thermo couple 39, and is managed by a terrestrial temperature control mechanism (a graphic display is omitted). The electromagnetic valves 54 and 54 for two way types, and 81 and 83 are installed in the middle of said cell liquid feed pipes 47 and 86 and 87, and the pipeline which branched with the upper electromagnetic valves 54 and 83 for two way types is connected with the head-of-water pipes 55 and 85 arranged to vertical facing up at the upper part in the centrum of the housing 41.

[0014]The cell liquid of the use top complement of this original position test equipment attaches the cell liquid container 20 by adiathermic construction material in the protective case 41b attached to the lower part

of the housing 41, and is accommodated in this cell liquid container 20. Into the cell liquid container 20, the air bag 24 which can expand for volume equal to the content volume of the container 20 is installed, Air is sent from a terrestrial pneumatic-control mechanism through the air pipe 90 linked to the air gate 25 of the air bag 24, the air bag 24 is expanded in a moderate size (volume), and the cell liquid of the volume expansion considerable amount is sent out. It is provided in said cell liquid container 20 in the two cell liquid delivery pipes 23 and 23. The electromagnetic valve 54 for two way types is first formed in one cell liquid delivery pipe 23, the differential pressure transducer 56 is formed, 2nd electromagnetic valve 54for two way types' is provided up from the position in which the cell liquid feed pipe 47 which reaches the pressurized space 42 for an examination branched, and it is connected with the upper head-of-water pipe 55. The pneumatic pressure pipe 57 piped from the pneumatic-control mechanism (see the numerals 61 of drawing 4 and the 62 grades) which omitted the terrestrial graphic display branches on the way, and is connected with said head-of-water pipe 55 and the differential pressure transducer 56.

[0015]The cell liquid feed pipe 87 with which the electromagnetic valve 81 for two way types is first formed also in cell liquid delivery-pipe 23' of another side, and the pipeline of the point results to the lower pressurized space 42b for assistance, It branches to the cell liquid feed pipe 86 which results to the upper pressurized space 42a for assistance, and the differential pressure transducer 82 is formed in the middle of the liquid feed pipe 86 which rises vertically. The 2nd electromagnetic valve 83 for two way types is formed in the upper part of said cell liquid feed pipe 86, and it is connected with the upper head-of-water pipe 85. And the pneumatic pressure pipe 84 piped from the same terrestrial pneumatic-control mechanism (mechanism which became independent although it was the pneumatic-control mechanism and the similar composition concerning said pneumatic pressure pipe 57) branches to two on the way, and is connected with said head-of-water pipe 85 and the differential pressure transducer 82.

[0016]Therefore, it is the stage which attached this original position test equipment at the tip of the drill rod 59, took it down in the hole 9 (refer to drawing 4) for an examination, and arrived at the test position, Air is first sent through the pneumatic pressure pipe 90, the air bag 24 is expanded, and the pressurized space 42 for an examination and the pressurized space 42a and 42b for assistance are supplied or supplemented with cell liquid. Pneumatic pressure is made to act on after an appropriate time through a terrestrial pneumatic-control mechanism to the head-of-water pipes 55 and 85 and the differential pressure transducers 56 and 82, The cell fluid pressure power of the strength (what is called a K_0 state is maintained) which restrains displacement of the radial direction (horizontal direction) of a porous wall to zero, respectively is made to act on the sealing sleeve 40 of the pressurized space 42 for an examination, and the sealing sleeves 40a and 40b of the pressurized space 42a and 42b for assistance of the upper and lower sides. The cell fluid pressure power in said pressurized space 42 for an examination at the time of the frozen ground board of an original position dissolving thoroughly in this way is read by a total of 62 in the pneumatic pressure of drawing 4 as a size of the pneumatic pressure in the head-of-water pipe 55 and the pneumatic pressure pipe 57 made to act on the differential pressure transducer 56, and genuine horizontal stress is called for.

[0017]

[A different embodiment] In the example of drawing 1, the head-of-water pipes 55 and 85 have projected for a while to the upper part of the device housing 41. In the conventional example of drawing 4, the head-of-

water pipe 55 is thoroughly exposed to the upper part of the device housing 41. Therefore, it is strongly cooled by the cold energy of the about -20 ** porous wall slurry filled in the hole for an examination, and such head-of-water pipes 55 and 85 have the inconvenience which the water (cell liquid) in a pipe freezes. In order to avoid such inconvenience, at the example of drawing 2, it is the head-of-water pipe 55 (and the head-of-water pipe 85 is also the same.). However, the concrete graphic display was omitted. It is below the same. It is installed at right angles to the central part in the transparent heat insulation container 10 which makes ** type cylindrical shape by the product made of an acrylic resin excellent in adiathermancy. The heat insulation container 10 is installed in the upper part part in the centrum of the transparent body 41a made of an acrylic resin added to the upper bed of the housing 41 in ****. However, the place is not a limitation of an example. It is filled by the level with which the seal water 11 for heat insulation sinks the anterior part of said head-of-water pipe 55 in the heat insulation container 10, and the heater 12 which warms this seal water 11 is also installed. The thermo couple 13 as a temperature sensor is installed in the upper and lower sides of said heat insulation container 10. The measurement value of the thermo couple 13 is inputted into a terrestrial temperature control mechanism (graphic display abbreviation), water temperature falls, and if the heater 12 is made to generate heat and it pulls the water temperature of the seal water 11 in being you, temperature control which keeps the water temperature in the head-of-water pipe 55 at about 12 ** - 13 ** is performed. Therefore, there are no worries about freezing of the water in the head-of-water pipe 55, and there are also no worries about the examination error by the volume change of water. The puddle 72 of quite big capacity which is open for free passage in said head-of-water pipe 55 is established in the upper part of said heat insulation container 10. This is for having composition which makes overflow water accommodate in the aforementioned puddle 72, and is not made to enter into the upper pneumatic pressure pipe 57 from the position, even when the water in the head-of-water pipe 55 overflows on the occasion of test preparation.

[0018]The end plate 30 is installed in the upper bed of the body 41a made of said acrylic resin in ****, and the joint part 31 which joins the drill rod 59 supported on the ground is formed in the upper surface center part of this end plate 30. The numerals 29 in drawing 1 are the water proof metal electric sockets provided as objects for connection, such as each controlling signal line. Next, drawing 3 shows the example of composition of that the cell liquid container portions which built in the air bag 24 differ. The protective case 41b made from stainless steel is added to the lower end part of said housing 41, and the cell liquid container 20 of well-closed container structure is stored by the adiathermic product made of a synthetic resin in the centrum of this protective case 41b. This cell liquid container 20 is formed by the inner capacity which can store the cell liquid 21 of the quantity needed on the function of the original position test equipment concerned. In the aforementioned cell liquid container 20, the cell liquid derivation hole 22 which has the exit 22a near [the] a pars basilaris ossis occipitalis has penetrated the side attachment wall of the cell liquid container 20 to the upper bed. The outlet nozzle 19 attached to the upper bed exit of said cell liquid derivation hole 22 is cell liquid feed pipe 23' (and the cell liquid feed pipe 23 is also the same.). However, the graphic display was omitted. It is connected with the nozzle 18 of the electromagnetic valve 81 for two way types for the above-mentioned pressurized space 42b for assistance. The air bag 24 which has the air gate nozzle 25 in the levee-crown wall of the container 20 in said cell liquid container 20 is stored. The cell liquid 21 extruded from the cell liquid container 20 is supplied to the pressurized space 42 for an examination, or

the pressurized space 42a and 42b for assistance through the electromagnetic valves 54 and 81 for two way types from the cell liquid feed pipes 23 and 23 by expanding the air bag 24. The pneumatic pressure pipe 90 is connected to the air gate nozzle 25 of said air bag 24, and this is connected with the pneumatic-control mechanism which omitted the terrestrial graphic display.

[0019]During an examination while giving original position test equipment in the hole for an examination and making test preparation, The pressurized space 42 for an examination and the pressurized space 42a for assistance, the temperature control that maintains the water temperature of the cell liquid in 42b at the range of about 12 ** - 13 **, And temperature control which maintains the temperature of the water in the head-of-water pipe 55 at approximately regulated is performed by the measurement by the temperature sensors 39 and 13, and warming with the heaters 52 and 12, and reservation of test accuracy is performed.

[0020]

[Effect of the Invention]According to the original position test equipment concerning this invention, the horizontal stress of the foundation by original position foundation freezing, The adverse effect by the up-and-down modification and collapse of a porous wall portion which adjoin the porous wall portion restrained by the sealing sleeve 40 of the pressurized space 42 for an examination is prevented by the sealing sleeves 40a and 40b of the up-and-down pressurized space 42a and 42b for assistance, and is called for with high precision. High-reliability can be examined with high precision in the state where there is moreover almost no error which worries about the trouble by freezing of cell liquid do not have, either, and originates in the temperature change (volume change of water) of water.

[Translation done.]

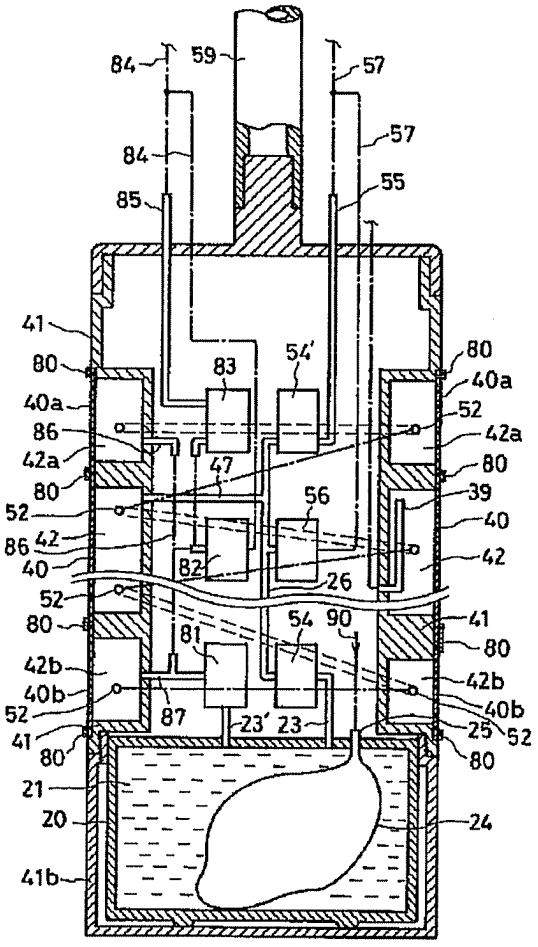
TECHNICAL FIELD

[Industrial Application]This invention relates to the original position test equipment used in order to ask for the horizontal stress of the foundation concerned directly in an original position after freezing nonviscous sandy ground and rudaceous ground in an original position.

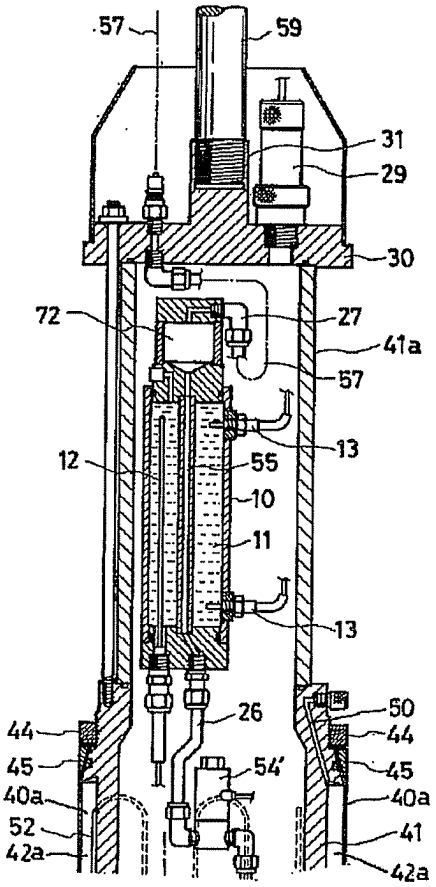
[Translation done.]

DRAWINGS

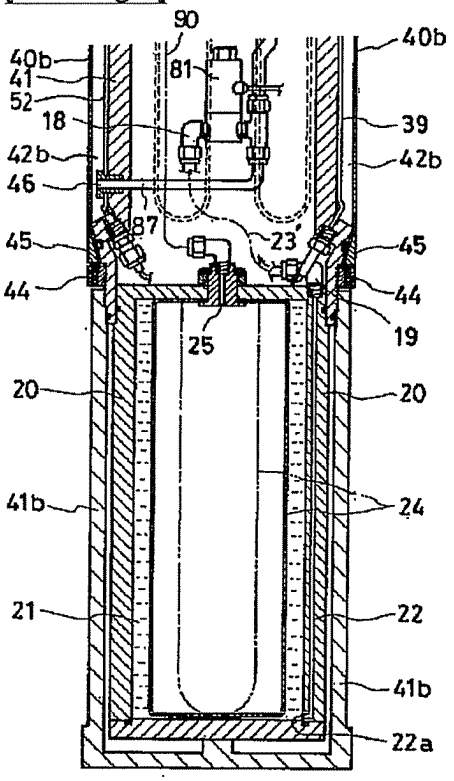
[Drawing 1]



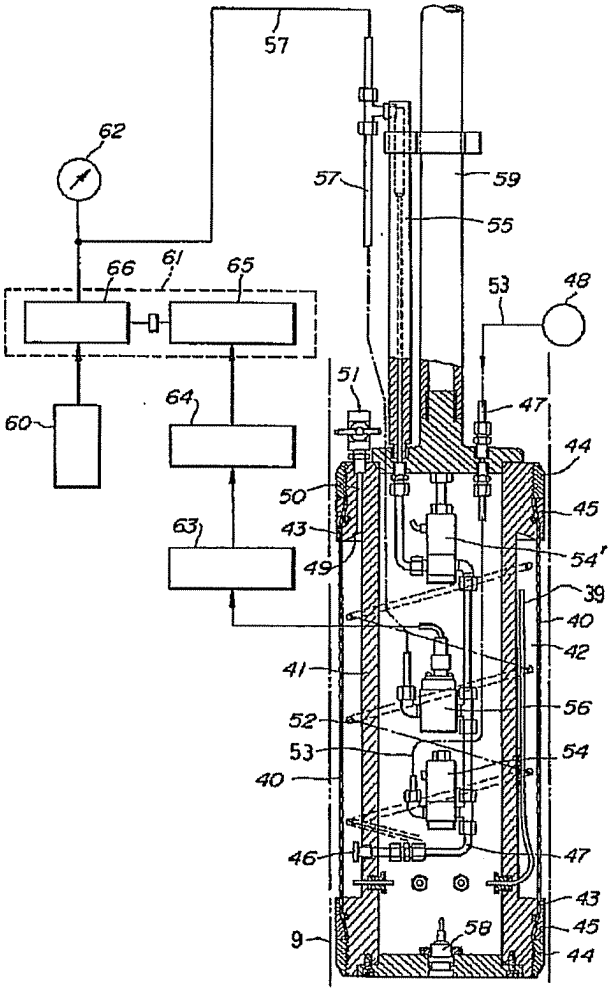
[Drawing 2]



[Drawing 3]



[Drawing 4]



[Translation done.]